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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/715,225	11/17/2003	Arun Kwangil Iyengar	YOR920030488US1 (163-16)	5015
24336 7590 02/26/2007 KEUSEY, TUTUNJIAN & BITETTO, P.C. 20 CROSSWAYS PARK NORTH SUITE 210 WOODBURY, NY 11797			EXAMINER TSAI, SHENG JEN	
			ART UNIT 2186	PAPER NUMBER
SHORTENED STATUTORY PERIOD OF RESPONSE			MAIL DATE	DELIVERY MODE
3 MONTHS			02/26/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/715,225	<b>Applicant(s)</b> IYENGAR ET AL.	
	<b>Examiner</b> Sheng-Jen Tsai	<b>Art Unit</b> 2186	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 23 January 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

### DETAILED ACTION

1. This Office Action is taken in response to Applicants' Remarks filed on January 17, 2007 regarding application 10,715,225 filed on November 17, 2003.
2. Claims 1-26 are pending for consideration.
3. ***Response to Remarks***

Applicants' amendments and remarks have been fully and carefully considered, with The Examiner's response set forth below.

Applicants contend that the reference (Iyengar, US Patent Application Publication 2003/0172236) does not teach "a consistency coordinator" and does not teach the limitations recited in claims 1, 10-11 and 17-18 regarding the "consistency coordinator." The Examiner disagrees with this assessment for the following reasons:

First, a "consistency coordinator" is not a standard term in the art. Lacking a standard definition as to what constitutes a "consistency coordinator," the Examiner must determine whether the reference teaches a "consistency coordinator" according to the functional limitations recited in the claim regarding the "consistency coordinator."

Second, the Examiner indicated in the previous Office Action that the corresponding "consistency coordinator" in Iyengar's invention is the "central cache" [figure 1, 100]. The Examiner believes that the "central cache" in Iyengar's invention performs all the functions (presented using **bold font**) of the "consistency coordinator" recited in claim 1, as demonstrated below:

**maintaining information regarding which storage elements are storing particular objects** [the central cache maintains local directories 110 which indicate the contents

Art Unit: 2186

of local caches. A local directory maintains information about what objects may, but do not necessarily have to be, cached in the corresponding local cache. These local directories 110 allow a central cache to update local caches (paragraph 0030); the central cache 102 stores information from at least one remote server 104. The central cache communicates with a plurality of processors 106 which contain local caches 108. The central cache contains information about what is stored in local caches 108. When cached data changes, the central cache 102 is notified. The central cache is then responsible for updating local caches 108 (paragraph 0026);

**communicates with the storage elements** [The central cache communicates with a plurality of processors 106 which contain local caches 108. The central cache contains information about what is stored in local caches 108. When cached data changes, the central cache 102 is notified. The central cache is then responsible for updating local caches 108 (paragraph 0026)];

**responding to a request to update an object** [in step 202 (figure 2), a request for an object is issued (column 5, lines 5-15)] **by using maintained information to**

**determine which of the storage elements may store a copy of the object** [The central cache contains information about what is stored in local caches 108. When cached data changes, the central cache 102 is notified. The central cache is then responsible for updating local caches 108 (paragraph 0026); In step 304, the central cache coordinates cache updates. That is, the central cache updates all objects it has cached which have changed. In addition, the central cache consults its local directories 110 to see which local caches may contain changed objects. Using local directories,

the central cache 102 sends appropriate update messages to local caches

(paragraphs 0039-0040)];

**instructing the storage elements, which the consistency coordinator suspects**

**store a copy of the object, to invalidate their copy of the object** [The central

cache communicates with the one or more local caches and coordinates updates to the

local caches, including cache replacement (abstract); In addition, the central cache

consults its local directories 110 to see which local caches may contain changed

objects. Using local directories, the central cache 102 sends appropriate update

messages to local caches (paragraphs 0039-0040); it is to be understood that the term

"update," as used herein, is meant not only to include changing the value of a data

object in a cache but also may include invalidating the data object or performing some

other operation on the object (paragraph 0010)]; **and**

**performing an update of the object after each storage element that includes the**

**copy of the object indicates that the storage element has invalidated the copy of**

**the object or the storage element is determined to be unresponsive** [For cached

objects, the central cache may keep a directory of which local caches are storing the

object. Updates to cached objects may go through the central cache. In order to

update a cache object, the central cache may communicate with the local caches to

make sure that all copies are invalidated or updated (paragraph 0011); in step 302

(figure 3), data changes, and the central cache is notified of the data changes.

Notification may be by way of one or more of the processors 106 informing the central

cache of any associated data changes. In step 304, the central cache coordinates

Art Unit: 2186

cache updates. That is, the central cache updates all objects it has cached which have changed. In addition, the central cache consults its local directories 110 to see which local caches may contain changed objects. Using local directories, the central cache 102 sends appropriate update messages to local caches (paragraphs 0039-0040)].

Thus, it is clear from the above analysis that the “central cache” in Iyengar’s invention performs all the functions of the “consistency coordinator” recited in claim 1.

Therefore, the Examiner’s position regarding the merits of patentability of all claims remains the same as stated in the previous Office Action.

**4. *Duplicate Claims, Warning***

Applicant is advised that should **claim 1** be found allowable, **claim 11** will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Applicant is advised that should **claim 1** be found allowable, **claim 2** will be objected to under 37 CFR 1.75 as being a substantial duplicate limitation that is already recited in claim 1.

Applicant is advised that should **claim 3** be found allowable, **claim 12** will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof.

Applicant is advised that should **claim 6** be found allowable, **claim 13** will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof.

Applicant is advised that should **claim 7** be found allowable, **claim 14** will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof.

Applicant is advised that should **claim 8** be found allowable, **claim 15** will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof.

Applicant is advised that should **claim 4** be found allowable, **claim 16** will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof.

Applicant is advised that should **claim 10** be found allowable, **claim 17** will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof.

**5. Claim Rejections - 35 USC § 102**

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-6, 10-12, 16-24 and 26 are rejected under 35 U.S.C. 102(e), as well as under 35 U.S.C. 102(a), as being anticipated by Iyengar et al. (U.S. Patent Application Publication 2003/0172236).

It is noted that, in the following claim analysis, those elements recited by the claims are presented using bold font.

As to claim 1, Iyengar et al. disclose in a **system comprised of a plurality of storage elements** [figure 1 shows a system comprising a central cache (110), a remote server (104) and a plurality of processors (106-1~106-N) where each of the processor has a copy of cache as storage element, hence a plurality of storage elements], a **method for maintaining objects in the storage elements** [Methods and Systems for Distributed Caching in Presence of Updates and in Accordance with Holding Times (abstract)] **comprising the steps of:**

**maintaining information regarding which storage elements are storing particular objects** [the central cache maintains local directories 110 which indicate the contents of local caches. A local directory maintains information about what objects may, but do not necessarily have to be, cached in the corresponding local cache. These local directories 110 allow a central cache to update local caches (paragraph 0030); the central cache 102 stores information from at least one remote server 104. The central cache communicates with a plurality of processors 106 which contain local caches 108.



The central cache contains information about what is stored in local caches 108. When cached data changes, the central cache 102 is notified. The central cache is then responsible for updating local caches 108 (paragraph 0026)] **in a consistency coordinator** [the central cache (figure 1, 110) is the corresponding consistency coordinator; The central cache communicates with the one or more local caches and coordinates updates to the local caches] **which communicates with the storage elements** [the central cache 102 stores information from at least one remote server 104. The central cache communicates with a plurality of processors 106 which contain local caches 108. The central cache contains information about what is stored in local caches 108. When cached data changes, the central cache 102 is notified. The central cache is then responsible for updating local caches 108 (paragraph 0026)]; **responding to a request to update an object** [in step 202 (figure 2), a request for an object is issued (column 5, lines 5-15)] **by using maintained information to determine which of the storage elements may store a copy of the object** [The central cache contains information about what is stored in local caches 108. When cached data changes, the central cache 102 is notified. The central cache is then responsible for updating local caches 108 (paragraph 0026); In step 304, the central cache coordinates cache updates. That is, the central cache updates all objects it has cached which have changed. In addition, the central cache consults its local directories 110 to see which local caches may contain changed objects. Using local directories, the central cache 102 sends appropriate update messages to local caches (paragraphs 0039-0040)];

**instructing the storage elements, which the consistency coordinator suspects store a copy of the object, to invalidate their copy of the object** [The central cache communicates with the one or more local caches and coordinates updates to the local caches, including cache replacement (abstract); In step 304, the central cache coordinates cache updates. That is, the central cache updates all objects it has cached which have changed. In addition, the central cache consults its local directories 110 to see which local caches may contain changed objects. Using local directories, the central cache 102 sends appropriate update messages to local caches (paragraphs 0039-0040); When cached data changes, the central cache 102 is notified. The central cache is then responsible for updating local caches 108 (paragraph 0026); it is to be understood that the term "update," as used herein, is meant not only to include changing the value of a data object in a cache but also may include invalidating the data object or performing some other operation on the object. The central cache may communicate remotely with processes running either on the same processing node or on different processing nodes. That way, several applications running on different processing nodes may communicate with the same cache (paragraph 0010)]; **and performing an update of the object after each storage element that includes the copy of the object indicates that the storage element has invalidated the copy of the object or the storage element is determined to be unresponsive** [For cached objects, the central cache may keep a directory of which local caches are storing the object. Updates to cached objects may go through the central cache. In order to update a cache object, the central cache may communicate with the local caches to

make sure that all copies are invalidated or updated (paragraph 0011); in step 302

(figure 3), data changes, and the central cache is notified of the data changes.

Notification may be by way of one or more of the processors 106 informing the central cache of any associated data changes. In step 304, the central cache coordinates cache updates. That is, the central cache updates all objects it has cached which have changed. In addition, the central cache consults its local directories 110 to see which local caches may contain changed objects. Using local directories, the central cache 102 sends appropriate update messages to local caches (paragraphs 0039-0040)].

As to claim 2, Iyengar et al. teach that **the step of maintaining information includes maintaining information regarding which storage elements are storing particular objects in the consistency coordinator** [The central cache contains information about what is stored in local caches 108. When cached data changes, the central cache 102 is notified. The central cache is then responsible for updating local caches 108 (paragraph 0026); In addition, the central cache consults its local directories 110 to see which local caches may contain changed objects. Using local directories, the central cache 102 sends appropriate update messages to local caches (paragraph 0040)].

As to claim 3, Iyengar et al. teach that **the consistency coordinator includes multiple nodes** [figure 1 shows the central cache (102), which is by itself one node, is connected to a remote server (104), which serves as another node to facilitate consistency coordination with remote storage elements; The central cache may communicate remotely with processes running either on the same processing node or

on different processing nodes. That way, several applications running on different processing nodes may communicate with the same cache (paragraph 0010)] **and each node of the consistency coordinator stores information for a different set of objects** [since local caches require extra space and may thus in some situations be of limited size, it is preferred to have one or more methods for determining which objects to store in a local cache. Such methods, referred to as cache replacement policies, are described below in accordance with the present invention (paragraph 0029)].

As to claim 4, lyengar et al. teach that **the storage elements include at least one cache** [figure 1 shows a plurality of nodes of processors (106-1~106-N) where each of the processor has a copy of cache as storage element].

As to claim 5, lyengar et al. teach that **the storage elements are included in a distributed system** [figure 1 shows the configuration of a distributed system; in one aspect, a distributed caching technique of the invention comprises the use of a central cache and one or more local caches (paragraph 0010)].

As to claim 6, lyengar et al. teach **the method as recited in claim 1, further comprising the step of obtaining a lock on the object to be updated before performing the update** [figure 5, steps 502, 504, 506 and 508; with respect to the locking or holding time issue, in another aspect, the invention provides techniques for adaptively determining such time values (paragraph 0013)].

As to claim 10, refer to "As to claim 1."

As to claim 11, refer to "As to claim 1."

As to claim 12, refer to "As to claim 3."

As to claim 16, refer to "As to claim 4."

As to claim 17, refer to "As to claim 1."

As to claim 18, refer to "As to claim 1."

As to claim 19, lyengar et al. teach that **the system as recited in claim 18, further comprising a writer, which updates the object to be updated** [it is to be understood that the term "update," as used herein, is meant not only to include changing the value of a data object in a cache (paragraph 0010). It is noted that changing the value of a data object inherently requires a write operation, hence a writer].

As to claim 20, lyengar et al. teach that **the writer resides on a same node as a storage element** [for example, the central cache which would update the cache data objects as shown in figure 1].

As to claim 21, refer to "As to claim 1."

As to claim 22, refer to "As to claim 1."

As to claim 23, lyengar et al. teach that **the system as recited in claim 18, further comprising at least one content provider** [for example, the central cache or the remote server as shown in figure 1; for instance, a cache may be implemented as a server in a network (e.g., a cache server or proxy caching server in a World Wide Web or Internet environment) (paragraph 0009)].

As to claim 24, lyengar et al. teach that **the content provider resides on a same node as a storage element** [for example, the central cache which would update the cache data objects as shown in figure 1].

As to claim 26, refer to "As to claim 4."

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 7-9, 14-15 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iyengar et al. (U.S. Patent Application Publication 2003/0172236) according to 102(a) as indicated in Section 6 of this Office Action, and in view of Chang et al. (US Patent Application Publication 2005/0128960).

As to claims 7-9, Iyengar et al. do not mention that **sending heart beat messages to obtain availability information to and from a storage element**.

However, Chang et al disclose in their invention "Method for Determination of Remote Adapter and/or Node Liveness" a heart beat message protocol for the determination of node liveness in a distributed data processing system [abstract; figures 6-8; paragraph 0017].

Using hear beat messages allows early detections of any failure component and prompt recovery operations to maintain high availability of system [Chang et al., paragraph 0003].

Therefore it would have been obvious for persons of ordinary skills in the art at the time of the applicant's invention to recognize the benefits using hear beat messages to identify faulty components as soon as possible, as demonstrated by Chang et al., and

to incorporate it into the existing apparatus and method disclosed by Iyengar et al., to further improve the availability and reliability of the system.

As to claims 14-15, refer to "As to claims 7-9."

As to claim 25, refer to "As to claims 7-9."

9. ***Related Prior Art of Record***

The following list of prior art is considered to be pertinent to applicant's invention, but not relied upon for claim analysis conducted above.

- Gannon et al., (US 5,265,232), "Coherency Control by Data Invalidation in Selected Processor Caches without Broadcasting to Processor Caches not Having the Data."
- Chang et al., (US 5,398,325), "Method and Apparatus for Improving Cache Consistency Using a Single Copy of a Cache tag Memory in Multi Processor Computer Systems."
- Butts, Jr. et al., (US 5,303,362), "Coupled Memory Multiprocessor Computer System Including Cache Coherency Management Protocols."
- Hayes et al., (US 6,073,212), "Reducing Bandwidth and Areas Needed for Non-Inclusive Memory Hierarchy by Using Dual Tags."
- McDonald et al., (US 6,012,127), "Multiprocessor Computing Apparatus with Optional Coherency Directory."
- Teramoto, (US 6,848,023), "Cache Directory Configuration Method and Information Processing Device."

***Conclusion***

10. Claims 1-26 are rejected as explained above.

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sheng-Jen Tsai whose telephone number is 571-272-4244. The examiner can normally be reached on 8:30 - 5:00.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Kim can be reached on 571-272-4182. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Sheng-Jen Tsai  
Examiner  
Art Unit 2186

February 16, 2007

  
PIERRE BATAILLE  
PRIMARY EXAMINER  
2/16/07